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IMPORTANT STUDIES OF THE ASSESSMENT AND IMPACT OF INDUSTRIAL EFFLUENTS OF BALOTRA TOWN OF BARMER DISTRICT ON THE QUALITY OF SURFACE AND UNDERGROUND WATER

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ABSTRACT

The important results of physico-chemical analysis of surface water sample, ground water sample and the surrounding Luni river water from the Balotra city near Jodhpur, are presented, with reference to their suitability for various uses and provide strategy for prevention and control of the ground water contamination during the monsoon season 2011-12. The important parameters like Temperature, turbidity, colour, total alkalinity, total hardness, calcium, magnesium, carbonate, fluoride, sulphate, phosphate, nitrate, TDS, dissolved oxygen, BOD and COD are monitored. The quality of water is found to be highly unsatisfactory for drinking purpose and other human consumption. It is expected that the possibility of diseases like eczema, contact dermatitis, asthma, chronic bronchitis, fluorosis and cancer may be increased due to polluted water. The fluoride concentration is so high that children are now born with twisted bones. Water pollution is controlled in this area by checking the said pollution by desalination and use of activated carbon, activated alumina and modified fly ash, but they are not satisfactory and Balotara's water is not even fit for bathing.

Key Words: *Phyco-Chemical Parameters, Industrial Effluents, Water Pollution*

INTRODUCTON

Balotra, a town situated about 100 km to the west of Jodhpur. The town is famous for its dyeing and printing process industry. The effluent from this industry, which consists of mainly dyes like Methylene Blue, Malachite Green, Rhodamine Band and various salts, is flushed into the nallah and Luni river. Dyeing industries are located around Luni river and other water sources and are discharging foul smelling, coloured, liquid effluent in the river.



Figure 1: Map of Balotra (Courtesy: Google Maps)

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Figure 2: LUNI BASIN IN RAJASTHAN (Courtesy: waterresource.gov.in)

A large amount of which is absorbed by the soil, causing water pollution. The farmers use the polluted water to irrigate their field. The vegetables and crops so produced are consumed by the human beings resulting into a number of health hazards. The highly alkaline and saline water is also causing damage to ground water. For dyeing of cloth large amount of water is required by the industries, which is supplied by dug wells in the agriculture field. High rate of water withdrawal has further deteriorated the quality of water.

There are 4 CETP in Balotra (Common effluent treatment plant). Their capacities are 12 mld, 6 mld, 8 mld and 4.5 mld.

About 40-45 industries affiliated with CETP-I and II have converted to synthetic processing in lieu of cotton processing, and as a result, their effluent has gotten more acidic. Since the present CETPs are not able to process such acidic effluents, smaldrains are dug which pours into the Luni river directly. There are many unregistered factories running making things worse. About half a million families in Balotra are affected due to contamination from effluent. The contaminated water has destroyed various crops like jowar, wheat, vegetables, and fodder, which all used to grow earlier.

The objective of the present study is to analyze the physico-chemical analysis of the textile effluent, underground water used for irrigation. This will help in assessing the effects of effluents and waste water on human beings. For this purpose monitoring the quality of effluent water and ground water is done at various locations.

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MATERIALS AND METHODS

Balotra is a small town of Western Rajasthan with a population of over 60000. Most of the dyeing and printing industries are located in a around the city. The water samples were collected from 8 different locations within a distance of 2 km for this study. The samples were collected in polythene bottles as per the standard procedure. All samples were stored in refrigerator at 4 degree Celsius. The physico chemical analysis of waste water and ground water was assessed during the month of July and August by standard methods as suggested by APHA (1990) and compared with the values prescribed by WHO (1980).

Table 1: BIS-standard parameters

Parameters	Permissible limit	Excessive limit
pH	6.5	8.5
Nitrate	45	100
Sulphate	200	400
TDS	500	2000
Chloride	250	1000
TA	200	600
TH	300	600
Fluoride	0.9	1.5

Table-2: Parameters and methods employed in the physicochemical examination of water samples

S. No.	Parameters of water analysis	Method Employed
1	pH	Potentiometric
2	Temperature (°C)	Thermometric
3	Conductivity (µS/cm)	Potentiometric
4	Turbidity (NTU)	Nephelometric
5	Total Dissolved solids	Gravimetric
6	Total Alkalinity (as CaCO ₃)	Titrimetric
7	Total Hardness (as CaCO ₃)	Titrimetric
8	Calcium hardness(as CaCO ₃)	Titrimetric
9	Magnesium Hardness (as CaCO ₃)	Titrimetric
10	Chloride (as Cl ⁻)	Titrimetric
11	Nitrate (as NO ₃ ⁻)	Spectrophotometric
12	Sulphate (as SO ₄ ²⁻)	Spectrophotometric
13	Fluoride (as F ⁻)	Ion Selective electrodes
14	Sodium (as Na ⁺)	Flame Photometric
15	Potassium (as K ⁺)	Flame Photometric
16	COD	Titrimetric
17	BOD	Titrimetric and spectrophotometric

The physico-chemical parameters like temperature, pH, electrical conductivity, TDS, alkalinity, DO, CO₂, COD, Cl⁻, were analyzed by using a potable kit, while COD, BOD, SO₄²⁻, Ca⁺⁺ and Mg⁺⁺ hardness were determined by volumetric method. Rest of the chemical parameters was analyzed in the laboratory by standard methods prescribed by APHA (1995). Double distilled water and AR grade chemicals were used wherever required

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RESULTS AND DISCUSSION

The analytical results of various tube wells/open wells., nallahs, Luni River and other places in Balotra city have been shown in table 2. It appears that the treated nallah water is not up to the desired level and does not achieve the norms laid by The State Pollution Control. Board. The temperature of the water sample is around 22 degree c. A pH range of 6.5 to 8.5 is normally acceptable as per guidelines suggested by WHO. The pH of the water samples ranged from 8 to 9.5. This shows that the water samples are very alkaline in nature. The alkaline pH is a usual feature of such water bodies. (Kulshreshtha et al. 2002, Welch 1952). The desirable limit for total alkalinity is 200mg/l. (IS -4343, 1967). The values of water samples varies from 400 -700-mg/l. In water it is useful as it provides buffering to resist changes in the BOD of water sample.

Table 3: Physico chemical parameters of effluent and under ground water in Balotra town of Jodhpur district, Jul-Aug, 2010-11

Parameters	Govt Girls school	Near Hospital	SDM office	Govt College	Main market	Near Rly stn	Near Brahma temple	Near effluent nallah
pH	7.7	7.9	7.8	8.2	7.9	7.8	7.6	9.9
Total alkalinity mg/l	400	470	560	580	560	580	490	700
Total hardness mg/l	550	570	520	520	640	680	550	690
Calcium hardness mg/l	250	260	250	330	310	280	220	300
Magnesium hardness mg/l	200	330	320	260	290	250	210	250
Carbonate hardness mg/l	400	470	560	520	510	580	550	610
Non carbonate hardness mg/l	150	100	130	100	130	100	75	200
Chloride mg/l	320	310	350	290	305	310	260	380
Sulphate mg/l	350	290	272	200	224	240	220	390
Nitrate mg/l	20	15	13	15	20	15	30	41
TDS mg/l	1400	1200	1440	1320	1371	1301	721	1650
Fluoride mg/l	0.9	1.0	1.5	2.3	1.45	1.4	1.6	2.8
BOD	180	185	195	200	150	100	100	195
COD	400	420	380	385	360	150	150	456

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The presence of higher BOD indicates entry of organic waste in the water sample. It is an indication of alarming conditions and hence treatment of water is needed before the use of water for various purposes. The BOD level of water sample varies from 100-200mg/l. The COD of water sample varies from 360 to 465 mg/l., which indicates highly polluted by industrial wastes. These high values indicated that drinking water sources are rich either with dissolved organic compounds or oxidisable inorganic substances. The ratio of BOD to COD is greater than or equal to 0.8, indicates that waste water is highly amenable to biological treatment.

Desirable limit of total dissolved solid is 1000 mg/l (WHO). All the values, except some points, are not in the limit. The chloride contents of water sample except some points have been found within the limit. It varied from 260 to 380 mg/l. The values show that in some cases the chloride contents is high, which impart salty taste to water. The permissible limit is 250mg/l (WHO) for drinking water. The desirable limit of sulphate in drinking water prescribed by ICMR is 200 to 400mg/l. All the water samples have satisfied this limit. The fluoride contents vary from 0.6 -2.8 mg/l. The permissible WHO limit is 1.5.mg/l and it is exceeded at few sites. If the fluoride concentration exceeds 2.0 mg/l and water is continuously used for years, it causes dental and skeletal fluorosis in men and cattle's. In all the samples, nitrate was within limits for general use. The TDS from all the sources was found to be well higher than the limit thus water from these sources is not suitable for drinking and laundry purpose.

Conclusion

It can be concluded that the Balotra city is highly polluted in terms of water pollution. The various parameters signify that immediate action should be taken to prevent water pollution. Although government has ordered to shut down various textile unit still many of them are running illegally making water highly polluted. This is affecting human health as more and more cancer cases, fluorosis cases, genetic disorders are reported from this area. The chemicals used for synthetic processing along with cotton processing are making effluent more acidic thereby severely affecting land and agriculture in this area. Therefore immediate action should be taken to reduce pollution, which is likely to exceed abnormally in the near future. It is suggested that each small scale textile unit should have an in built effluent treatment plant and common treatment plant for common effluents.

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